WHAT IS CLAIMED IS:

Sub A1 1. A method of estimating transmitted data symbols from a plurality of signal samples received by a plurality of receivers, said data symbols being part of included in a data stream that is divided into a plurality of substreams, each of said received signal samples including at least one data symbol from each of said plurality of substreams, said method comprising:

(a) representing said plurality of signals samples as a function of a plurality of transmitted data symbols and a plurality of channel response values, each of said plurality of channel response values representing a respective signal response for a transmission path of at least one of said plurality of transmitted data symbols, at least a portion of said plurality of channel response values including channel responses caused by multipath scattering;

(b) defining a plurality of estimated data symbols as a function of said plurality of signals samples, said function satisfying a performance related criterion;

(c) determining a difference expression that represents a difference between a function of said plurality of estimated data symbols and a function of said plurality of signal samples, said difference expression being a sum of a plurality of terms;

(d) selecting values for each of a portion of said plurality of estimated data symbols such that one of said plurality of terms is minimized;

(e) selecting values for a further portion of said plurality of estimated data symbols such that a further one of said plurality of terms is minimized, said further one of said plurality of terms being a function of said further portion of said plurality of estimated data symbols and said selected values of said plurality of estimated data symbols; and

(f) repeating step (e) until each of said plurality of terms is minimized.

2. The method of claim 1 wherein each of said plurality of substreams is respectively transmitted by a respective one of said plurality of transmitters, and each of said received signal samples includes at least one data symbol from each of said plurality of transmitters.

3. The method of claim 1 wherein each of said plurality of substreams represents a respective one of a plurality of users, and each of said received signal samples includes at least one data symbol from each of said plurality of users.

4. The method of claim 1 wherein said function of a plurality of transmitted data symbols and a plurality of channel response values is defined by the following relation:

$$\underline{x}^j = \mathbf{A}^j \underline{s} + \underline{n}^j \qquad \in \mathbf{C}^{N\times 1},$$

wherein $\underline{x}^j$ is a vector representing N stacked signals samples received at a receiver antenna j, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{s}$ is an vector representing said transmitted data symbols, $\underline{n}^j$ is a vector representing additive white Gaussian noise that is received by said receiver antenna j while each of said N stacked signal samples is being received.

5. The method of claim 1 wherein said performance related criterion is a minimum mean squared error (MMSE) and said function of said plurality of signals samples is defined by the following relation:

$$\hat{\underline{s}} = \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \left[\mathbf{A}^j\right] + \sigma^2 \mathbf{R}_{ss}^{-1} \right)^{-1} \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \underline{x}^j \right),$$

wherein $\hat{\underline{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\{\underline{s}\underline{s}^H\} = \mathbf{I}$.

6. The method of claim 1 wherein said performance related criterion is zero forcing (ZF) and said function of said plurality of signals samples is defined by the following relation:

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$$\hat{\underline{s}} = \left(\sum_{j=1}^{n}[\mathbf{A}^j]^H[\mathbf{A}^j]\right)^{-1}\left(\sum_{j=1}^{n}[\mathbf{A}^j]^H\underline{x}^j\right),$$

wherein $\hat{\underline{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\{\underline{s}\underline{s}^H\} = \mathbf{I}$.

7. The method of claim 1 wherein said difference expression is defined by the following relation:

$$\underbrace{\left\|\mathbf{L}^H\hat{\underline{s}} - \underline{z}\right\|^2}_{=\underline{\Delta}} = \underbrace{\left\|\mathbf{L}_{QQ}\hat{\underline{s}}_Q - \underline{z}_Q\right\|^2}_{=\underline{\Delta}_Q} + \underbrace{\left\|\mathbf{L}_{Q-1,Q-1}\hat{\underline{s}}_{Q-1} + \mathbf{L}_{Q-1,Q}\hat{\underline{s}}_Q - \underline{z}_{Q-1}\right\|^2}_{=\underline{\Delta}_{Q-1}}$$

$$+\cdots+\underbrace{\left\|\sum_{j=i}^{Q}\mathbf{L}_{ij}\hat{\underline{s}}_j - \underline{z}_i\right\|^2}_{=\underline{\Delta}_i} + \cdots + \underbrace{\left\|\sum_{j=1}^{Q}\mathbf{L}_{1j}\hat{\underline{s}}_j - \underline{z}_1\right\|^2}_{=\underline{\Delta}_1},$$

wherein

$$\mathbf{L}_{ij} = \begin{bmatrix} l_{W(i-1),W(j-1)} & \cdots & l_{W(i-1),(W-1)j} \\ \vdots & \vdots & \vdots \\ l_{(W-1)i,W(j-1)} & \cdots & l_{(W-1)i,(W-1)j} \end{bmatrix} \in C^{W \times W},$$

$$\hat{\underline{s}}_i = \begin{bmatrix} \hat{s}_{W(i-1)} \\ \vdots \\ \hat{s}_{(W-1)i} \end{bmatrix} \in C^{W \times 1},$$

$\hat{s}_j$ represents a block said plurality of estimated data symbols,

$$\underline{z}_i = \begin{bmatrix} z_{W(i-1)} \\ \vdots \\ z_{W(i-1)i} \end{bmatrix} \in C^{W \times 1},$$

z_j represents said function of said signal samples, W is a size of a block, Q is a number of blocks in N transmitted data symbols such that Q = N/W.

8. The method of claim 7 wherein said performance related criterion is a minimum mean squared error (MMSE) and **L** is defined by the following relation:

$$\left(\sum_{j=1}^{n} \left[\mathbf{A}^j \right]^H \left[\mathbf{A}^j \right] + \sigma^2 \mathbf{R}_{ss}^{-1} \right) = \mathbf{L}\mathbf{L}^H$$

wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, and $\mathbf{R}_{ss} = \varepsilon\left\{ \underline{s}\underline{s}^H \right\} = \mathbf{I}$.

9. The method of claim 7 wherein said performance related criterion is zero forcing (ZF) and $\mathbf{L}$ is defined by the following relation:

$$\left(\sum_{j=1}^{n} \left[\mathbf{A}^j \right]^H \left[\mathbf{A}^j \right] \right) = \mathbf{L}\mathbf{L}^H$$

wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values.

10. The method of claim 7 wherein said one of said plurality of terms is $\underline{\Delta}_Q$, and said further one of said plurality of terms is, successively, $\underline{\Delta}_{Q-1}$, $\underline{\Delta}_{Q-2}$, ..., $\underline{\Delta}_i$, ..., $\underline{\Delta}_1$.

11. An apparatus for estimating transmitted data symbols from a plurality of signal samples received by a plurality of receivers, said data symbols being part of a data stream that is divided into a plurality of substreams, each of said received signal samples including at least one data symbol from each of said plurality of substreams, said apparatus being configured to:

(a) represent said plurality of signals samples as a function of a plurality of transmitted data symbols and a plurality of channel response values, each of said plurality of channel response values representing a respective signal response for a transmission of at

least one of said plurality of transmitted data symbols, at least a portion of said plurality of channel response values including channel responses caused by multipath scattering;

(b) define a plurality of estimated data symbols as a function of said plurality of signals samples, said function satisfying a performance related criterion;

(c) determine a difference expression that represents a difference between a function of said plurality of estimated data symbols and a function of said plurality of signal samples, said difference expression being a sum of a plurality of terms;

(d) select values for each of a portion of said plurality of estimated data symbols such that one of said plurality of terms is minimized;

(e) select values for a further portion of said plurality of estimated data symbols such that a further one of said plurality of terms is minimized, said further one of said plurality of terms being a function of said further portion of said plurality of estimated data symbols and said selected values of said plurality of estimated data symbols; and

(f) repeat element (e) until each of said plurality of terms is minimized.

12. The apparatus of claim 11 wherein each of said plurality of substreams is respectively transmitted by a respective one of said plurality of transmitters, and each of said received signal samples includes at least one data symbol from each of said plurality of transmitters.

13. The apparatus of claim 11 wherein each of said plurality of substreams represents a respective one of a plurality of users, and each of said received signal samples includes at least one data symbol from each of said plurality of users.

14. The apparatus of claim 11 wherein said function of a plurality of transmitted data symbols and a plurality of channel response values is defined by the following relation:

$$\underline{x}^j = \mathbf{A}^j \underline{s} + \underline{n}^j \quad \in \mathbf{C}^{N\times 1},$$

wherein $\underline{x}^j$ is a vector representing N stacked signals samples received at a receiver antenna j, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{s}$ is a vector representing said transmitted data symbols, $\underline{n}^j$ is a vector representing additive white Gaussian noise that is detected by said receiver antenna j while each of said N stacked signal samples is being detected.

15. The apparatus of claim 11 wherein said performance related criterion is a minimum mean squared error (MMSE) and said function of said plurality of signals samples is defined by the following relation:

$$\hat{\underline{s}} = \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \left[\mathbf{A}^j\right] + \sigma^2 \mathbf{R}_{ss}^{-1} \right)^{-1} \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \underline{x}^j \right),$$

wherein $\hat{\underline{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\left\{\underline{ss}^H\right\} = \mathbf{I}$.

16. The apparatus of claim 11 wherein said performance related criterion is zero forcing (ZF) and said function of said plurality of signals samples is defined by the following relation:

$$\hat{\underline{s}} = \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \left[\mathbf{A}^j\right] \right)^{-1} \left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \underline{x}^j \right),$$

wherein $\hat{\underline{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\{\underline{s}\underline{s}^H\} = \mathbf{I}$.

17. The apparatus of claim 11 wherein said difference expression is defined by the following relation:

$$\underbrace{\left\| \mathbf{L}^H \hat{\underline{s}} - \underline{z} \right\|^2}_{=\underline{\Delta}} = \underbrace{\left\| \mathbf{L}_{QQ} \hat{\underline{s}}_Q - \underline{z}_Q \right\|^2}_{=\underline{\Delta}_Q} + \underbrace{\left\| \mathbf{L}_{Q-1,Q-1} \hat{\underline{s}}_{Q-1} + \mathbf{L}_{Q-1,Q} \hat{\underline{s}}_Q - \underline{z}_{Q-1} \right\|^2}_{=\underline{\Delta}_{Q-1}}$$

$$+ \cdots + \underbrace{\left\| \sum_{j=i}^{Q} \mathbf{L}_{ij} \hat{\underline{s}}_j - \underline{z}_i \right\|^2}_{=\underline{\Delta}_i} + \cdots + \underbrace{\left\| \sum_{j=1}^{Q} \mathbf{L}_{1j} \hat{\underline{s}}_j - \underline{z}_1 \right\|^2}_{=\underline{\Delta}_1},$$

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wherein

$$\mathbf{L}_{ij} = \begin{bmatrix} l_{W(i-1),W(j-1)} & \cdots & l_{W(i-1),(W-1)j} \\ \vdots & \vdots & \vdots \\ l_{(W-1)i,W(j-1)} & \cdots & l_{(W-1)i,(W-1)j} \end{bmatrix} \in C^{W\times W},$$

$$\hat{\underline{s}}_i = \begin{bmatrix} \hat{s}_{W(i-1)} \\ \vdots \\ \hat{s}_{(W-1)i} \end{bmatrix} \in C^{W\times 1},$$

$\underline{\hat{s}}_j$ represents a block said plurality of estimated data symbols,

$$\underline{z}_i = \begin{bmatrix} z_{W(i-1)} \\ \vdots \\ z_{W(i-1)i} \end{bmatrix} \in C^{W \times 1},$$

z_j represents said function of said signal samples, W is a size of a block, Q is a number of blocks in N transmitted data symbols such that Q = N/W.

18. The apparatus of claim 17 wherein said performance related criterion is a minimum mean squared error (MMSE) and **L** is defined by the following relation:

$$\left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \left[\mathbf{A}^j\right] + \sigma^2 \mathbf{R}_{ss}^{-1} \right) = \mathbf{LL}^H$$

wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, and $\mathbf{R}_{ss} = \varepsilon\left\{\underline{ss}^H\right\} = \mathbf{I}$.

19. The apparatus of claim 17 wherein said performance related criterion is zero forcing (ZF) and **L** is defined by the following relation:

$$\left(\sum_{j=1}^{n} \left[\mathbf{A}^j\right]^H \left[\mathbf{A}^j\right] \right) = \mathbf{LL}^H$$

wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values.

20. The apparatus of claim 17 wherein said one of said plurality of terms is $\underline{\Delta}_Q$, and said further one of said plurality of terms is, successively, $\underline{\Delta}_{Q-1}$, $\underline{\Delta}_{Q-2}$, ...,$\underline{\Delta}_i$,..., $\underline{\Delta}_1$.

21. A computer readable medium comprising:

instructions for estimating transmitted data symbols from a plurality of signal samples received by a plurality of receivers, said data symbols being part of included in a data stream that is divided into a plurality of substreams, each of said received signal samples including at least one data symbol from each of said plurality of substreams, said instructions comprising:

(a) instructions for representing said plurality of signals samples as a function of a plurality of transmitted data symbols and a plurality of channel response values, each of said plurality of channel response values representing a respective signal response for a transmission path of at least one of said plurality of transmitted data symbols, at least a portion of said plurality of channel response values including channel responses caused by multipath scattering;

(b) instructions for defining a plurality of estimated data symbols as a function of said plurality of signals samples, said function satisfying a performance related criterion;

(c) instructions for determining a difference expression that represents a difference between a function of said plurality of estimated data symbols and a function of said plurality of signal samples, said difference expression being a sum of a plurality of terms;

(d) instructions for selecting values for each of a portion of said plurality of estimated data symbols such that one of said plurality of terms is minimized;

(e) instructions for selecting values for a further portion of said plurality of estimated data symbols such that a further one of said plurality of terms is minimized, said further one

of said plurality of terms being a function of said further portion of said plurality of estimated data symbols and said selected values of said plurality of estimated data symbols; and

(f) instructions for repeating instruction (e) until each of said plurality of terms is minimized.

22. The medium of claim 21 wherein each of said plurality of substreams is respectively transmitted by a respective one of said plurality of transmitters, and each of said received signal samples includes at least one data symbol from each of said plurality of transmitters.

23. The medium of claim 21 wherein each of said plurality of substreams represents a respective one of a plurality of users, and each of said received signal samples includes at least one data symbol from each of said plurality of users.

24. The medium of claim 21 wherein said function of a plurality of transmitted data symbols and a plurality of channel response values is defined by the following relation:

$$\underline{x}^{j} = \mathbf{A}^{j}\underline{s} + \underline{n}^{j} \qquad \in \mathbf{C}^{N\times 1},$$

wherein $\underline{x}^{j}$ is a vector representing N stacked signals samples received at a receiver antenna j, $\mathbf{A}^{j}$ is a matrix representing said plurality of channel response values, $\underline{s}$ is a vector representing said transmitted data symbols, $\underline{n}^{j}$ is a vector representing additive white Gaussian noise that is received by said receiver antenna j while each of said N stacked signal samples is being received.

25. The medium of claim 21 wherein said performance related criterion is a minimum mean squared error (MMSE) and said function of said plurality of signals samples is defined by the following relation:

$$\underline{\hat{s}} = \left(\sum_{j=1}^{n} \left[\mathbf{A}^{j} \right]^{H} \left[\mathbf{A}^{j} \right] + \sigma^{2} \mathbf{R}_{ss}^{-1} \right)^{-1} \left(\sum_{j=1}^{n} \left[\mathbf{A}^{j} \right]^{H} \underline{x}^{j} \right),$$

wherein $\underline{\hat{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\{\underline{s}\underline{s}^H\} = \mathbf{I}$.

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26. The medium of claim 21 wherein said performance related criterion is zero forcing (ZF) and said function of said plurality of signals samples is defined by the following relation:

$$\underline{\hat{s}} = \left(\sum_{j=1}^{n} \left[\mathbf{A}^{j} \right]^{H} \left[\mathbf{A}^{j} \right] \right)^{-1} \left(\sum_{j=1}^{n} \left[\mathbf{A}^{j} \right]^{H} \underline{x}^{j} \right),$$

wherein $\underline{\hat{s}}$ represents said plurality of estimated data symbols, $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, $\underline{x}^j$ is a vector representing N stacked signals samples received at each of said plurality of receivers, $\underline{s} \sim N(\underline{0}, \mathbf{R}_{ss})$, and $\mathbf{R}_{ss} = \varepsilon\{\underline{s}\underline{s}^H\} = \mathbf{I}$.

27. The medium of claim 21 wherein said difference expression is defined by the following relation:

$$\underbrace{\left\| \mathbf{L}^{H} \underline{\hat{s}} - \underline{z} \right\|^{2}}_{=\underline{\Delta}} = \underbrace{\left\| \mathbf{L}_{QQ} \underline{\hat{s}}_{Q} - \underline{z}_{Q} \right\|^{2}}_{=\underline{\Delta}_{Q}} + \underbrace{\left\| \mathbf{L}_{Q-1,Q-1} \underline{\hat{s}}_{Q-1} + \mathbf{L}_{Q-1,Q} \underline{\hat{s}}_{Q} - \underline{z}_{Q-1} \right\|^{2}}_{=\underline{\Delta}_{Q-1}}$$

$$+\cdots+\underbrace{\left\|\sum_{j=i}^{Q}\mathbf{L}_{ij}\hat{\underline{s}}_j-\underline{z}_i\right\|^2}_{=\underline{\Delta}_i}+\cdots+\underbrace{\left\|\sum_{j=1}^{Q}\mathbf{L}_{1j}\hat{\underline{s}}_j-\underline{z}_1\right\|^2}_{=\underline{\Delta}_1},$$

wherein

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$$\mathbf{L}_{ij}=\begin{bmatrix} l_{W(i-1),W(j-1)} & \cdots & l_{W(i-1),(W-1)j} \\ \vdots & \vdots & \vdots \\ l_{(W-1)i,W(j-1)} & \cdots & l_{(W-1)i,(W-1)j} \end{bmatrix} \in C^{W\times W},$$

$$\hat{\underline{s}}_i=\begin{bmatrix} \hat{s}_{W(i-1)} \\ \vdots \\ \hat{s}_{(W-1)i} \end{bmatrix} \in C^{W\times 1},$$

$\hat{\underline{s}}_j$ represents a block said plurality of estimated data symbols,

$$\underline{z}_i=\begin{bmatrix} z_{W(i-1)} \\ \vdots \\ z_{W(i-1)i} \end{bmatrix} \in C^{W\times 1},$$

z_j represents said function of said signal samples, W is a size of a block, Q is a number of blocks in N transmitted data symbols such that Q = N/W.

28. The medium of claim 27 wherein said performance related criterion is a minimum mean squared error (MMSE) and **L** is defined by the following relation:

$$\left(\sum_{j=1}^{n}\left[\mathbf{A}^{j}\right]^{H}\left[\mathbf{A}^{j}\right]+\sigma^{2}\mathbf{R}_{ss}^{-1}\right) = \mathbf{L}\mathbf{L}^{H}$$

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wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values, and $\mathbf{R}_{ss}$= $\varepsilon\left\{\underline{s}\underline{s}^{H}\right\} = \mathbf{I}$.

29. The medium of claim 27 wherein said performance related criterion is zero forcing (ZF) and **L** is defined by the following relation:

$$\left(\sum_{j=1}^{n}\left[\mathbf{A}^{j}\right]^{H}\left[\mathbf{A}^{j}\right]\right) = \mathbf{L}\mathbf{L}^{H}$$

wherein $\mathbf{A}^j$ is a matrix representing said plurality of channel response values.

30. The medium of claim 27 wherein said one of said plurality of terms is $\underline{\Delta}_Q$, and said further one of said plurality of terms is, successively, $\underline{\Delta}_{Q-1}$, $\underline{\Delta}_{Q-2}$, ...,$\underline{\Delta}_i$,..., $\underline{\Delta}_1$.

31. An apparatus for estimating transmitted data symbols from a plurality of signal samples received by a plurality of receivers, said data symbols being part of a data stream that is divided into a plurality of substreams, each of said received signal samples including at least one data symbol from each of said plurality of substreams, said apparatus comprising:

(a) means for representing said plurality of signals samples as a function of a plurality of transmitted data symbols and a plurality of channel response values, each of said plurality of channel response values representing a respective signal response for a transmission path of at least one of said plurality of transmitted data symbols, at least a portion of said plurality of channel response values and including channel responses caused by multipath scattering;

(b) means for defining a plurality of estimated data symbols as a function of said plurality of signals samples, said function satisfying a performance related criterion;

(c) means for determining a difference expression that represents a difference between a function of said plurality of estimated data symbols and a function of said plurality of signal samples, said difference expression being a sum of a plurality of terms;

(d) means for selecting values for each of a portion of said plurality of estimated data symbols such that one of said plurality of terms is minimized;

(e) means for selecting values for a further portion of said plurality of estimated data symbols such that a further one of said plurality of terms is minimized, said further one of said plurality of terms being a function of said further portion of said plurality of estimated data symbols and said selected values of said plurality of estimated data symbols; and

(f) means for repeating (e) until each of said plurality of terms is minimized.